MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

PSM0325 – INTRODUCTION TO PROBABILITY AND STATISTICS

(Foundation in Information Technology / Life Sciences)

28 FEBRUARY 2020
3.00pm – 5.00pm
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **THREE** pages excluding the cover page and the Appendix.
2. Answer **ALL FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided. All necessary working steps **MUST** be shown.
4. **Statistical table** is provided.

Instruction: Answer all **FIVE** questions.

Question 1 (10 marks)

a. The followings are the marks obtained by the students of PTM0145 last semester.

55	54	76	70	77	82	84	66	80	61
62	64	80	85	78	42	72	63	85	80
72	69	54	76	80	66	85	82	79	53
78	53	69	80	92	74	74	61	54	58
81	86	58	72	90	78	38	85	69	42

i. Construct a grouped frequency distribution. Use classes 30 – 39, 40 – 49, etc. Hence identify the class mode. (3 marks)

ii. Sketch the bar chart for the distribution. Identify if the distribution skewed to the left, normal or skewed to the right. (3 marks)

b. Calculate the mean and the variance for the following sample grouped data. (4 marks)

Class	Frequency
2 - 4	3
5 - 7	4
8 - 10	2
11 - 13	1

Question 2 (10 marks)

a. The probability density function of a random variable X is given below:

$$f(x) = \begin{cases} k(3x-2); & 0 < x < 4 \\ 0; & otherwise \end{cases}$$

i. Show that $k = \frac{1}{16}$. (2 marks)

ii. Calculate the mean of X. (3 marks)

b. Three fair coins are tossed. Let X be the number of heads obtained.

i. Construct a probability distribution for X. (2 marks)

ii. Find its mean and standard deviation. (3 marks)

Continued...

Question 3 (10 marks)

a. The heights of coconut trees along a beach are normally distributed with a mean of 4.55m and a standard deviation of 0.37m.

i. Find the probability that a randomly chosen tree has a height greater than 4.55m. (1 mark)

ii. Find the probability that a randomly chosen tree will be within 2 standard deviations of the mean. (2 marks)

iii. The probability that a particular tree is less than x meter tall is 0.75. Find the value of x. (2 marks)

b. The number of cars sold by an agent follows a Poisson distribution with a mean of 3 cars per week.

i. Find the probability that the agent can sell 5 cars in a week. (2 marks)

ii. Find the probability that the agent can sell more than 10 cars in three weeks. (3 marks)

Question 4 (10 marks)

a. Consider the population of 5 numbers:

45 45 48 50 50

i. Four numbers are selected without replacement. List all the possible samples and calculate the mean for each sample. (4 marks)

ii. Construct the sampling distribution of $\bar{x}$. (2 marks)

b. A sample of 100 smokers were asked on how many cigarettes they smoke per week. The sample mean was 12.38 and the standard deviation 3.45. Calculate the 88% and 99% confidence interval. (4 marks)

Question 5 (10 marks)

a. Write the null and alternative hypothesis for the following and determine if it is a two-tailed, a left-tailed or a right-tailed test.

i. A researcher thinks that if expectant mothers use vitamins, the birth weight of the babies will increase. The average birth weight of the population is 2.8 kilograms. (2 marks)

Continued...

ii. A psychologist feels that playing soft music during a test will change the results of the test. The psychologist is not sure whether the grades will be higher or lower. In the past, the mean of the scores was 73. (2 marks)

b. Blood glucose levels for obese patients have a mean of 100 with a standard deviation of 15. A researcher thinks that a diet high in raw cornstarch will have a positive or negative effect on blood glucose levels. A sample of 30 patients who have tried the raw cornstarch diet have a mean glucose level of 140.

i. Set up the hypothesis test, H_0 and H_1. (2 marks)

ii. Test the hypothesis that the raw cornstarch had an effect at 5% significance level. What is the conclusion? (4 marks)

End of Paper

APPENDIX

Formulae:

1.

	Ungrouped data	Grouped data
Mean:	$\bar{x}=\frac{\sum x}{n} \qquad \mu=\frac{\sum x}{N}$	$\bar{x}=\frac{\sum mf}{n} \qquad \mu=\frac{\sum mf}{N}$
Variance:	$s^2=\frac{\sum x^2-\frac{\left(\sum x\right)^2}{n}}{n-1}$ $\sigma^2=\frac{\sum x^2-\frac{\left(\sum x\right)^2}{N}}{N}$	$s^2=\frac{\sum m^2 f-\frac{\left(\sum mf\right)^2}{n}}{n-1}$ $\sigma^2=\frac{\sum m^2 f-\frac{\left(\sum mf\right)^2}{N}}{N}$
Median:		$L+\left[\frac{\left[\frac{\sum f+1}{2}\right]-F_L}{f_m}\right]w$
Mode:		$L+\left[\frac{f_m-f_B}{(f_m-f_B)+(f_m-f_A)}\right]w$

2.

	Mean	Variance
Discrete Random Variable X	$\mu=E(X)$ $=\sum xP(x)$	$Var(X)=E\left(X^2\right)-[E(X)]^2$ where $E\left(X^2\right)=\sum x^2P(x)$
Continuous Random Variable X	$\mu=E(X)$ $=\int_{-\infty}^{\infty} xf(x)dx$	$Var(X)=E\left(X^2\right)-[E(X)]^2$ where $E\left(X^2\right)=\int_{-\infty}^{\infty} x^2f(x)dx$

3.

	Formula	Mean	Standard Deviation
Binomial Probability	$P(x)=\binom{n}{x}p^xq^{n-x}$	$\mu=np$	$\sigma=\sqrt{npq}$
Poisson Probability	$P(x)=\frac{e^{-\lambda}\lambda^x}{x!}$	$\mu=\lambda$	$\sigma=\sqrt{\lambda}$

4. The z value for a value of x: $z = \dfrac{x - \mu}{\sigma}$

5. The z value for a value of $\bar{x}$: $z = \dfrac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}}$

   where $\mu_{\bar{x}} = \mu$ and $\sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}}$

6. Sampling error = $\bar{x} - \mu$
   Non-sampling error = incorrect $\bar{x}$ − correct $\bar{x}$

7. Point estimate of $\mu = \bar{x}$

   Margin of error = $\pm 1.96\sigma_{\bar{x}} = \pm 1.96\dfrac{\sigma}{\sqrt{n}}$ or $= \pm 1.96 s_{\bar{x}} = \pm 1.96\dfrac{s}{\sqrt{n}}$

8. The $(1-\alpha)100\%$ confidence interval for μ is

   $\bar{x} \pm z\sigma_{\bar{x}}$ is known

   $\bar{x} \pm z s_{\bar{x}}$ if σ is not known

   where $\sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}}$ & $s_{\bar{x}} = \dfrac{s}{\sqrt{n}}$